Bell Work
4-Feb-2016

Balance the following equation;

$\_Al + \_O_2 \rightarrow \_Al_2O_3$

How many moles **of Aluminum Oxide are produced from the combustion of 3 moles of Aluminum (think about the balanced equation and a molar ratio)**

Objective:

You will be able to set up a mole bridge using a balanced equation.

Stoichiometry

Stoichiometry

Balance the following equation:

$$4\ NH_3 + 5\ O_2 \rightarrow 6\ H_2O + 4\ NO$$

What is the ratio between ammonia and nitrogen monoxide? **4:4 or $\frac{4\text{mol } NH_3}{4\text{mol NO}}$**

What is the ratio between Nitrogen monoxide and oxygen? **4:5 or $\frac{4\text{ mol NO}}{5\text{ mol } O_2}$**

So for every 4 mol of NO you have 5 mol of O_2.

Stoichiometry

$4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

So many conversion factors exist:

4 mol NH_3/5 mol O_2, 6 mol H_2O/4 mol NH_3, etc

What if you had 2 mol of NO, how many moles of O_2 would you have?

$$2\text{mol NO} \times \frac{5\text{mol } O_2}{4\text{mol NO}} = 2.5\text{mol } O_2$$

What if you had 6 mol of H_2O, how many moles of O_2 would you have?

$$6\text{mol } H_2O \times \frac{5\text{mol } O_2}{6\text{mol } H_2O} = 5\text{mol } O_2$$

Stoichiometry

"Stoichiometry" refers to the relative quantities of moles. It also refers to calculations that make use of mole ratios.

Stoichiometry

$4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

Recall also that molar masses provide factors:

$$\frac{1 \text{ mol } NH_3}{17 \text{ g } NH_3} \qquad \frac{32 \text{ g } O_2}{1 \text{ mol } O_2}$$

Is $\frac{4 \text{ g } NH_3}{5 \text{ g } O_2}$ **a conversion factor?**

No!

The equation tells us moles not grams.

Stoichiometry Question 1a

Consider : $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

How many moles of H_2O are produced if 0.176 mol of O_2 are used?

$$\#\ \text{mol } H_2O = 0.176\ \text{mol } O_2 \times \frac{6\ \text{mol } H_2O}{5\ \text{mol } O_2} =$$

0.21 mol H_2O

Notice: A correctly balanced equation is essential to get the right answer

Stoichiometry questions (1b)

Consider : $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

How many moles of NO are produced in the reaction if 17 mol of H_2O are also produced?

$$\#\ \text{mol NO} = 17\ \text{mol } H_2O \times \frac{4\ \text{mol NO}}{6\ \text{mol } H_2O} =$$

11.33 mol NO

Notice: A correctly balanced equation is essential to get the right answer!

Read

233-235, work out example problem on page 234.

Bell Work
02-05-2016

2 GC + 1 M + 3 CP → 1 SM

GC = graham cracker

M = marshmallow

CP = chocolate pieces

SM = s'more

1.) How many of each ingredient is needed to make s'mores for a class of 20 students?

2.) How many s'mores can you make with 85 chocolate pieces?

Recall

What is essential to perform stiochiometry?

Stoichiometry questions 1c

Consider : $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

How many moles of NH_3 are needed in the rxn if 0.5 mol of H_2O are also produced?

$$\#\ \text{mol } NH_3 = 0.5\ \text{mol } H_2O \times \frac{4\ \text{mol } NH_3}{6\ \text{mol } H_2O}$$

= 0.33 mol NH_3

This is what anhydrous ammonia will do to your skin

The "Mole Bridge"

The Mole Bridge is used to convert from one type of compound to another via their molar ratio based on a *Balanced* equation.

You have just converted from one type of compound to another in moles.

Now what if you wanted to go from moles of one compound to grams of another?

The "Mole Bridge"

Now what if you wanted to go from moles of one compound to grams of another?

Moles of A → grams of B

$$\text{mol A} \times \frac{\text{mol B}}{\text{mol A}} \times \frac{\text{Molar Mass B}}{1\ \text{mol B}} = \text{grams B}$$

The Mole Bridge

Your Turn

Consider : $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

How many grams of H_2O are produced if 1.9 mol of NH_3 are combined with excess oxygen?

$$\#\ g\ H_2O = 1.9\ \text{mol } NH_3 \times \frac{6\ \text{mol } H_2O}{4\ \text{mol } NH_3} \times \frac{18\ g\ H_2O}{1\ \text{mol } H_2O} =$$

51 g H_2O

Your Turn

Consider : $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$

How many grams of O_2 are required to produce 0.3 mol of H_2O?

$$\#\ g\ O_2 = 0.3\ \text{mol } H_2O \times \frac{5\ \text{mol } O_2}{6\ \text{mol } H_2O} \times \frac{32\ g\ O_2}{1\ \text{mol } O_2} = \mathbf{8\ g\ O_2}$$

Before You Go

Write out the steps for completing stiochiometery.

HW:

Read p. 233-237

Work out all examples and complete #28-32

Bell Work
8-Feb-2016

1. Name the following compounds:

$(NH_4)_2Cr_2O_7$ **PCl_5** **$Mo(PO_4)_2$**

2. What are the molar masses of each compound?
3. What do the coeficients infront of species in a balance equation represent?

Agenda

Percent Yeild

Practice ~~and pre-lab~~

Objective:

You understand that some reactants run out before others and will be able to determine the limiting reagent in a reaction

Percent Yield Practice

When the following rxn is called a mini "volcano"

$(NH_4)_2Cr_2O_7 \rightarrow N_2 + H_2O + Cr_2O_3$

Balance it

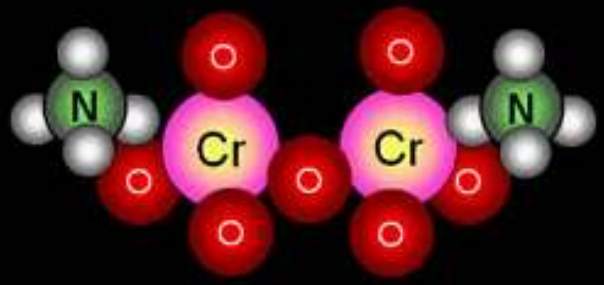
What type of reaction is this?

When 3.0g of the reactant is heated how many grams of the chromium containing product would you expect to get?

Percent Yield Practice

When the following reaction takes place it is called a mini "volcano"

$$(NH_4)_2Cr_2O_7 \rightarrow N_2 + 4H_2O + Cr_2O_3$$

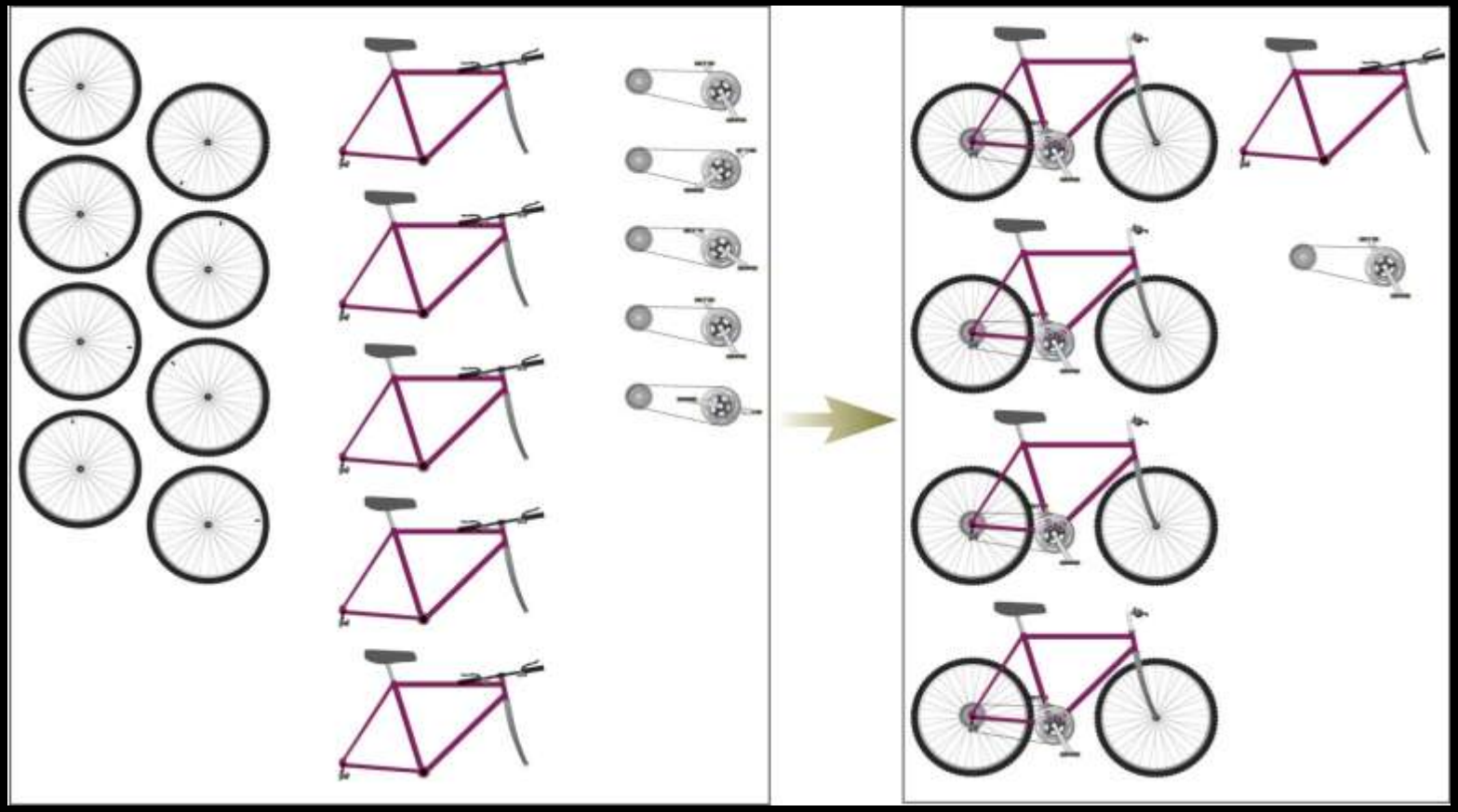


$$\% \text{ Yield} = \frac{\text{Actual}}{\text{Theoretical}} \times 100$$

If we actually got 1.1g of chromium (III) oxide, what is our percent yield?

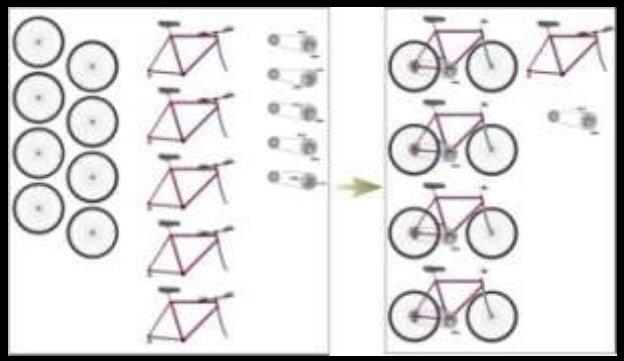
Limiting Reagent

The reactant that is completely consumed by the reaction.



Limiting Reagent

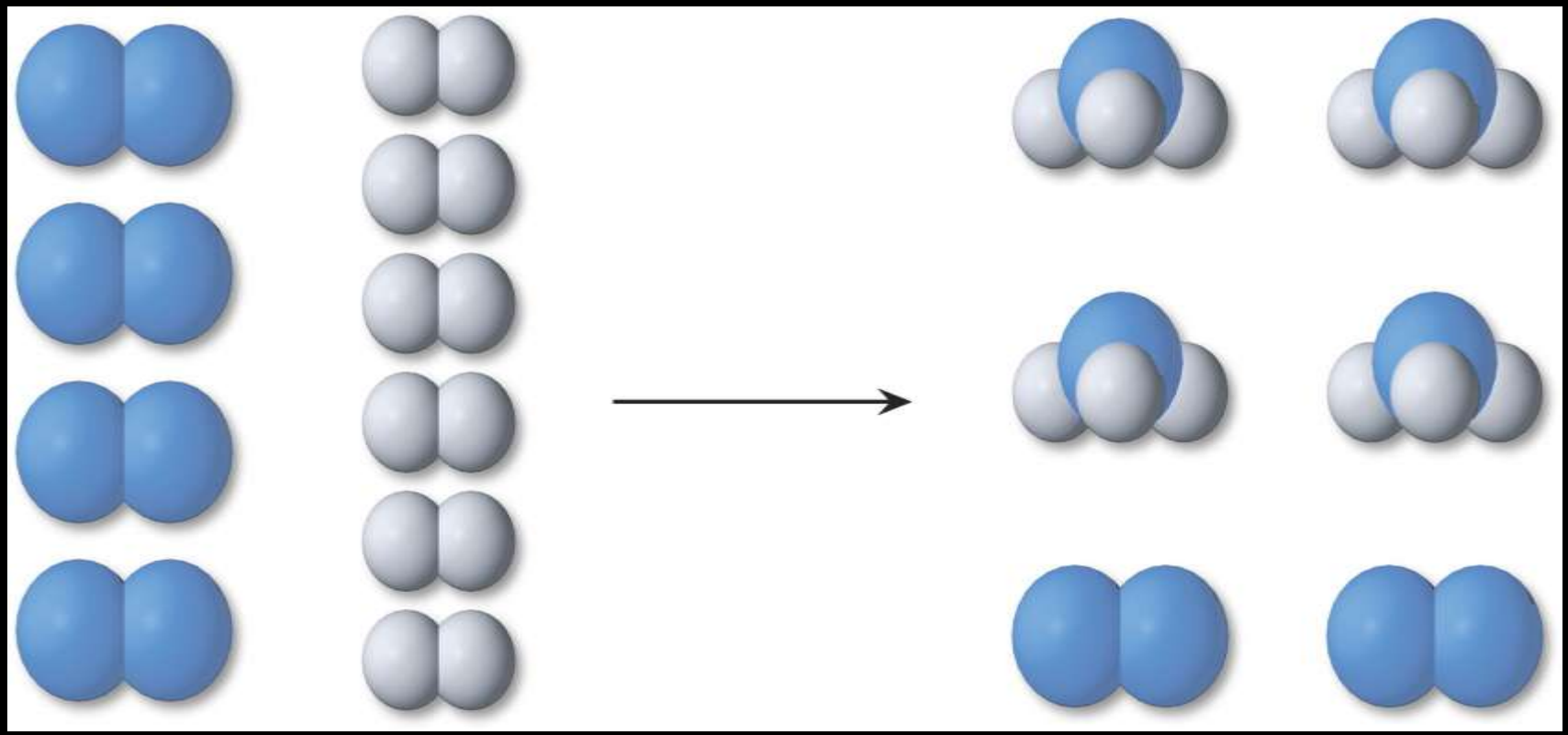
The reactant that is completely consumed by the reaction



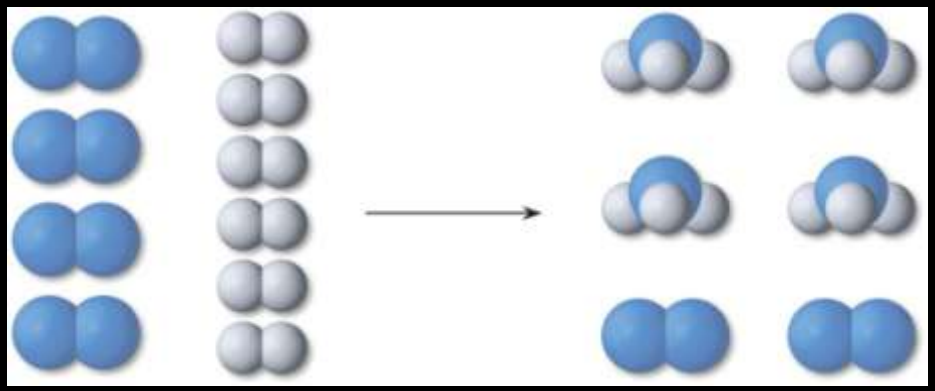
The number of bicycles that can be assembled is limited by whichever part runs out first. In the inventory shown in this figure, wheels are that part.

Limiting Reagent

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$



Limiting Reagent



A molecular view of a Limiting reactant situation for the ammonia synthesis. To make 4 molecules of NH_3 requires 2 molecules of N_2 & 6 molecules of H_2. If we start with 4 molecules of N_2 and 6 molecules of H_2, H_2 is the limiting reactant.

Limiting Reagent

So to find limiting reagents carry out the stiochiometry for each of your reactants that you are give a quantity for.

The reactant that gives you the smallest value of product is your limiting reagent.

Use this reactant for all calculations

Limiting Reagent

$$4KO_{2(s)} + 2H_2O_{(l)} \rightarrow 4KOH_{(s)} + 3O_{2(g)}$$

a. How many moles of O_2 can be produced from 0.15 mol KO_2 and 0.10 mol H_2O?

b. Determine the limiting reactant.

$$4KO_2(s) + 2H_2O(l) \rightarrow 4KOH(s) + 3O_2(g)$$

0.15 mol **0.10 mol** **? moles**

Limiting Reagent

b. Determine the limiting reactant.

$$4KO_2(s) + 2H_2O(l) \rightarrow 4KOH(s) + 3O_2(g)$$

0.15 mol **0.10 mol** **? moles**

Based on KO_2 :

$$0.15 \text{ mol } \cancel{KO_2} \times \frac{3 \text{mol } O_2}{4 \text{mol } \cancel{KO_2}} = 0.1125 \text{ mol } O_2$$

Limiting Reagent

b. Determine the limiting reactant.

$$4KO_2(s) + 2H_2O(l) \rightarrow 4KOH(s) + 3O_2(g)$$

0.15 mol **0.10 mol** **? moles**

Based on **H_2O:**

$$0.10 \text{ mol } H_2O \times \frac{3 \text{mol } O_2}{2 \text{mol } H_2O} = 0.15 \text{ mol } O_2$$

Limiting Reagent

b. Determine the limiting reactant.

$$4KO_2(s) + 2H_2O(l) \rightarrow 4KOH(s) + 3O_2(g)$$

0.15 mol **0.10 mol** **? moles**

Based on KO_2 : **= 0.1125 mol O_2**

Based on H_2O: **= 0.15 mol O_2**

KO_2 is the limiting reagent because it limited the amount of O_2 that could be produced. H_2O is the excess reagent.

Practice questions

1. **$2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$**
   If 25 g of aluminum was added to 90 g of HCl, what mass of H_2 will be produced?

2. **$N_2 + 3H_2 \rightarrow 2NH_3$: If you have 20 g of N_2 and 5.0 g of H_2, which is the limiting reagent?**

Practice questions

2. **$N_2 + 3H_2 \rightarrow 2NH_3$: If you have 20 g of N_2 and 5.0 g of H_2, which is the limiting reagent?**

3. **What mass of aluminum oxide is formed when 10.0 g of Al is burned in 20.0 g of O_2?**

Bell Work
10-Feb-2016

Candle wax reacts with oxygen to form water and carbon dioxide through the following chemical reaction:

$\_\_C_{40}H_{82} + \_\_0_2 \rightarrow \_\_CO_2 + \_\_H_20$

1. **Balance the equation**
2. **If there is approximately 1.1 g of oxygen in the container and the mass of the candle is 0.8 g what is the limiting reagent for this reaction (MM $C_{40}H_{82}$ = 562 g/mol)?**

Objective

You will see limiting reagents in the lab

Limiting Reagent Pre lab

You will make a full pre-lab, you may use the table in the handout for recording data

Limiting Reagent Lab

You will work in groups of at your lab bench

The molar ratio will be:

4people
6rxns

Or **4people**
6balloons

Limiting Reagent Lab

Limiting reagents are so easy! I figured it out, even after pooping my pants

Person A mass out of $NaHCO_3$

Person B help person D Clean and dry all test tubes, **do not over use paper towels!**

Person C will use a 10mL graduated cylinder to obtain the $HC_2H_3O_2$

Before you go

List the steps you would use to determine how to find the amount of the non-limiting reagent that is left over from a reaction.